City of Alexandria, Virginia

MEMORANDUM

DATE: AUGUST 25, 2003

TO: THE HONORABLE MAYOR AND MEMBERS OF CITY COUNCIL

THROUGH: PHILIP SUNDERLAND, CITY MANAGER

FROM: RICHARD J. BAIER, P.E., DIRECTOR, T&ES

SUBJECT: UPDATE ON CITY'S STORM, SANITARY AND COMBINED SEWER SYSTEM INFRASTRUCTURE

The purpose of this memorandum is three-fold: first, to provide a description of the three types of sewers that fall within the City's overall sewer infrastructure system; second, to explain the weather conditions occurring earlier this year that led to sanitary sewer backups and storm water flooding in parts of the City; and, third, to describe all the actions the City is undertaking to address and alleviate these backup and flooding problems (including some new actions that have recently been started).

The City's Sewer Infrastructure System

Alexandria has three sewer infrastructure systems: a combined sanitary and storm water sewer system, a separate sanitary sewer system, and a separate storm water sewer system.

1. Combined Sewer System. Combined sewer systems are common in older cities throughout the United States. In a combined sewer system (CSS), the same pipe carries both sanitary waste and storm/rain water. Alexandria has a combined sewer system that comprises about 38 miles of pipes and serves an area of about 540 acres. As shown on Attachment 1, this area is primarily located east of the railroad corridor and centered around Old Town. The remainder of the City, approximately 9,400 acres, is served by separate sewers, both sanitary and storm.

During dry weather, the City's combined sewer system usually carries wastewater only, which flows into and is treated at the Alexandria Sanitation Authority (ASA) wastewater treatment plant. During moderate wet weather, the combined system carries both waste and storm water, which flows into the ASA plant. However, during and immediately following heavy wet weather, the flow of waste and storm water (predominantly the latter) in the system can exceed the system's capacity, with the result that some of the flow is discharged through a CSS outfall

into the Potomac River, Hunting Creek and/or Hooffs Run. This type of discharge event is called a combined sewer overflow (CSO).

The Virginia Department of Environmental Quality (DEQ) issued a permit in August 2001 that covered, or "permitted," the City's four CSS outfalls. One of these permitted outfalls is at the east end of Pendleton Street, another is at the south end of Royal Street, and the remaining two are at Hooffs Run approximately where it runs under Jamieson Avenue (near the new Marriott on Duke Street). The DEQ permit allows for wet weather overflows. To minimize the impacts of overflows, the permit contains conditions that require extensive sampling, monitoring, modeling and maintenance activities and regular reporting. The City is in compliance with these permit conditions.

By operating the combined sewer system in accordance with the DEQ permit and with acceptable best practices, the City is not required to undertake the extremely expensive and disruptive construction that would be necessary to replace the combined system with separate sanitary and storm sewer systems. Even though wet weather overflows from the four CSS outfalls are permitted, the City continues to make efforts to minimize their occurrences and environmental impacts. This is done through the controls prescribed in the permit, through sanitary sewer capital projects, and by separating portions of combined system as opportunities arise (e.g., the waste and storm water from the redeveloped Samuel Madden Homes property will be entirely separated). Also, the City is initiating a study to identify opportunities to reduce the areas contributing to the combined system that can be undertaken in conjunction with redevelopment activities, especially along the newly built "Potomac Yard Trunk Sewer" (a separate sanitary sewer line running from the Yard directly to the ASA treatment plant).

2. Separate Sanitary Sewer System. A separate sanitary system serves all areas of the City outside the area served by the combined system. As you well know, in the Four Mile Run, Commonwealth and Taylor Run sewer service areas, the sanitary sewers are in need of repair to prevent infiltration and inflow (I/I). (See Attachment 2). Infiltration and inflow add ground and storm water to the sanitary system. Infiltration is groundwater leaking into the sanitary sewer pipe system; inflow consists of illicit roof drains and basement sump pumps that are connected to the sanitary system. The latter practice was allowed by the City until about 30 years ago, but is no longer allowed.

Separate sanitary sewers are sized to carry wastewater (and not storm water) from homes and businesses to the ASA treatment plant. Over the years, these sewers have lost their "tightness" as a result, for instance, of leaky joints and cracks in pipes. This has allowed rainwater to enter the sewer pipes directly, as well as groundwater that is fed by rainfall. In intense storms and periods of high groundwater, this infiltration and inflow of rainwater can cause the capacity of the separate sanitary system to be exceeded. When this occurs, sewage can backup into the basements of homes. If the sewers fill completely, sewage can run out of manholes and onto streets.

3. Separate Storm Water Sewer System. A separate storm water system also serves all areas in the City outside the combined sewer area. This system provides storm water drainage for streets and other areas such as parking lots and yards. Storm water systems are designed to convey storm water for a designated storm size, usually (as is the case with the City's system) for what is known as a 10-year storm event. In this region, the 10-year storm event equates to a rainfall intensity of approximately 2.6 inches in one hour. Storm water runoff rates are significantly affected by the groundwater saturation level, the groundwater table itself and impervious surface or ground areas within the watersheds.

In the City's storm water system, water enters storm sewers through street curb inlets (catch basins), as well as inlets in parking lots and grass areas, and then flows through underground storm sewer pipes to a point of discharge. These pipes typically discharge to the closest watercourse depending on the topography of the watershed. Watercourses in the City that receive storm water discharge include the Four Mile Run, Taylor Run, Hooffs Run and Timberbranch Run. These watercourses eventually discharge the storm water into the Potomac River or a water body that flows into the Potomac. Some storm water does not actually enter a storm sewer at all. Instead, it flows directly to a watercourse, or to a drainage swale or ditch that flows directly into a watercourse.

This Year's Weather Conditions and Events

Because of the high rainfall this year[1] and the very wet and/or saturated ground conditions, the City has experienced sanitary sewer backups, as well as surface flooding conditions arising from storm water that was not being carried by the storm system. Although sewer backups and storm water flooding have typically occurred every four to eight years (e.g., the last year of major sanitary sewer backups was 1996), this year has been especially fraught with problems.

This year's sewer episodes have occurred even though the individual storms did not produce the intensities and amount of overall rainfall characteristic of the 10-year storm. This year there were two major wet weather events -- the events of February 22 and June 19 -- where significant sewer backups and other flooding occurred. The February 22 event produced a total rainfall of about 2.6 inches spread out over about a 24-hour period, and the June 19 event produced a total rainfall of between 1.6 and 1.8 inches in about a one-hour period. Both rainfall events were characteristic of storms less than the ten-year storm and were more in the range of two-year storms.

However, during both the February and June rain events, local climatic conditions were such that the effects of the events were characteristic of storms of substantially greater magnitude.

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[1] At this point in the year, rainfall recorded at Reagan National Airport is about 14 inches above normal, and was very much above the normal in the months of February, May and June.

- The February 22 rain event occurred in conjunction with a very significant snow melt.[2] Together, these conditions caused sharp increases in the amount of water "infiltrating" and "inflowing" into sanitary sewers, which in turn overloaded the sewers and the ASA treatment plant.

- The June 19 rain event occurred after nearly two months of rainfall that was in the range of two to three times above normal. With the ground highly saturated, the June 19 rainfall produced runoff rates characteristics of a much larger storm, and perhaps greater than a 10-year storm.

Under very unusual weather conditions like these, it is the low lying areas of the City that are most impacted. These areas include Del Ray, Rosemont, Hume Springs, Lynhaven and Arlandria.

City Actions to Alleviate Combined Sewer and Sanitary System-Related Backups and Storm Water System-Related Surface Flooding

The City has had problems of various degrees with our three sewer systems over the years. While some actions have been taken in the past, it was not until relatively recently that the City has addressed the problems in a more long-term and permanent manner -- through public education, the creation of remedial programs to assist the public during an interim period, and a number of projects (some capital, some operating) designed to correct the underlying problems. The actions taken to date and those to be taken by the City are described below.

1. Combined Sewer System Actions. As to the combined sewer system, there are two major areas of concern and of action: "Tanyard Ditch" and the Colonial Avenue area.

a. Tanyard Ditch. The Tanyard Ditch flooding area is a low-lying area generally along Gibbon Street between South Royal and South Pitt Streets, and along South Royal Street between Wolfe and Duke Streets. The only outlet for rain water in this area is a combined sewer referred to as the Tanyard Ditch. During periods of intense rainfall, the Tanyard Ditch sewer fills up to a point where no additional water can be accepted. As a result, storm water collects in these low lying areas and can flood adjacent residences. In some cases, the combined sewer itself surcharges, or overflows, and contributes to the flooding situation.

The Capital Improvement Program (CIP) includes a multi-year, $4.4 million project (the "Royal Street Relief Sewer" project which runs through FY 2006) to design and construct a relief sewer for the Tanyard Ditch flooding area. Of these funds, $3.2 million have already been included in the budget up to and including FY 2004. To date, the City has conducted community meetings to inform the public and solicit input on the project.

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[2] In the days immediately preceding February 22, we had received a total of 18 inches of snow. The season total of snow by that date was 42 inches.

The goals of this project are:

- To construct a new large diameter storm sewer and outfall to the Potomac River that will provide expedient storm water drainage for properties now subject to repetitive first floor flooding in the 400 block area of Gibbon Street, between South Royal and South Pitt Streets.

- To provide sufficient capacity in this new large diameter storm sewer and outfall to allow additional branch connections into the pipe in the future in order to improve the street drainage capacity in other parts of Old Town.

This project is currently under design, with a projected construction start date of late summer or early fall 2004; the projected completion date is spring 2005.

b. Colonial Avenue. The Colonial Avenue combined sewer issue relates to an area of relatively infrequent combined sewer back-ups. The combined sewer lines in this area are currently being scanned by cameras to check for pipe breakage and/or blockages. Since the combined system in this area has experienced infrequent backups, repair funds have not been placed in the CIP. Based on the conditions we discover as a result of the camera work, funding for repair work will be considered in the upcoming CIP development process.

2. Sanitary System Actions. With regard to the separate sanitary system, the City has taken a number of actions in the areas of capital improvements, a financial assistance program and public education.

a. Capital Improvements. A number of sanitary sewer capital projects are in the current CIP.

i. I/I Project. The current CIP includes $17.8 million to correct the I/I and backflow problems in the Four Mile Run and Commonwealth sanitary sewer service areas (see Attachment 2). This reflects the acceleration of the funding for this project, which was discussed during the FY 2004 budget work sessions and incorporated into the CIP approved by Council.

This project includes evaluation, design of needed repairs to sanitary sewers and manholes, and construction of these repairs. The first phase of the I/I project is the Four Mile Run sanitary sewer area, to be followed by the Commonwealth area. Repair and rehabilitation work will consist of relining and replacing sanitary sewers in public rights-of-way that have been identified as damaged. The work will also consist of repairing leaking manholes and replacing manhole covers that now allow storm water run-off to leak into the sewers. Work in the Four Mile Run service area is expected to begin this fall and to finish in summer 2004; work in the Commonwealth area is anticipated to begin in fall 2004 and to be completed in summer 2005. To date, we have completed the sewer system evaluation in the Four Mile Run area and are finalizing the construction documents for the repair work. This contract will be advertised for bids in

September 2003. We are wrapping up the evaluation of the Commonwealth area and will have construction documents for its repair work complete by September 2004.

ii. Repair and Reconstruction Projects. The City budgets approximately $320,000 annually for on-going sanitary sewer repair and reconstruction projects to reline, repair and replace aging sanitary sewers. Projects are identified on an annual basis based on recurring maintenance needs and areas identified as under capacity. In FY 2003, these funds are being used to replace undersized and deteriorated sanitary sewers in locations throughout the City. Two examples are West Uhler Avenue and Caton Street.

iii. Holmes Run Trunk Sewer. Approximately $8 million dollars has either been budgeted or planned in the CIP, from FY 2001 through FY 2009, to increase the capacity of the Holmes Run Trunk Sewer in the western part of the City. This additional capacity is necessary to support future development in the Eisenhower Valley. The design and construction of this project is being managed jointly with the Alexandria Sanitation Authority which is the owner of this and the other trunk sewers in the City.

iv. System Maps. The City has budgeted, in the FY 2002 through FY 2005 period, $1,365,000 to update our sanitary and storm sewer system maps. Currently, we do not have a comprehensive inventory of existing sewers. Maps were last updated in the 1970s and projects completed since that time (both public and private) were not well mapped. A current map of these systems is critical to the City's ability to maintain and manage its infrastructure. It will also assist the City in determining whether sufficient capacity exists to support proposed development or whether privately funded improvements are necessary. These maps will be compatible with and become a part of the City's Geographical Information System.

b. Financial Assistance. The financial assistance action taken by the City is the backflow preventer program. This program offers cost reimbursement assistance for property owners in the designated affected area who decide to install backflow preventers on their sanitary sewer laterals. The program provides for a reimbursement of 50% of the total installation cost for the backflow preventer up to a maximum reimbursement of $500.00. The program began this year in mid-April and, to date, we have received five applications for reimbursement. Three have been processed, one for $500.00, one for $477.50 and one for $413.00. The other two applications are pending. The backflow preventer program is scheduled to run for six months, to October 15. It may be extended another six months by the City Manager if staff believe additional time is needed for affected residents to fully participate in the program.

c. Public Education. The public education program, in the area of sanitary sewers, has consisted of the following:

- citizen association meetings for the effected areas of Rosemont, Del Ray, and Hume Springs (Lynhaven and Arlandria are being scheduled for the fall)

- the posting of information on the City website
- numerous press releases
- a mass mailing of over 3,500 back flow prevention program brochures (see Attachment 3)
- several local newspaper articles designed to promote public awareness
- a public service film (to be aired on Comcast later this fall) that is now in the making
- City staff answering specific questions from residents who have called or visited the City.

This public education program has been undertaken through an interdepartmental effort by Transportation and Environmental Services, the Office of Citizen Assistance, and the City Manager's Office.

3. Storm Water System Actions.

a. Capital Projects. The City budgets approximately $350,000 annually for storm sewer projects that upgrade existing storm sewers which have been identified as being under capacity, and that provide new storm sewer capacity in areas of repeated flooding. These projects are identified City-wide based on the need for continued maintenance and problem flooding areas.

One example of a project in the current CIP is the intersection of Commonwealth Avenue and Glebe Road. A localized drainage analysis was conducted due to continued flooding in this location, and a solution identified which is to add additional capacity to the system at the intersection. Construction is underway to implement this additional capacity. A comprehensive study of this local storm water drainage shed is planned to begin in the spring to identify additional areas of frequent flooding and related capacity concerns which may lead to additional capital projects in future years.

In addition to projects in the current CIP, we have identified, and will undertake, three other storm sewer improvements that are needed to alleviate future flooding at locations that experienced flooding in February and June. One such improvement will occur in the alley between Franklin and Jefferson Streets, where two new catch basins will be installed, and the sewer line in the alley will be connected to the existing storm sewer in South Columbus Street. A second improvement will take place in the alley behind South Pitt Street near Gibbon Street, where a larger storm sewer pipe will be installed, and the alley will be resurfaced to facilitate proper drainage. A third improvement will occur in the alley behind the west side Colonial Avenue, which will be resurfaced to facilitate proper drainage. The cost of these three improvements is $32,500, and the work will be performed this fall.[3]

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[3] The alley behind Wayne Street to Nelson Avenue has also experienced flooding. This alley has no existing drainage system. T&ES will evaluate the drainage in this alley and the

b. Maintenance Work. In addition to projects that expand storm sewer capacity, each year the City undertakes a variety of storm sewer repair and maintenance activities. For example, this year the City has made catch basin repairs at South Royal and Green Streets, North Beauregard Street and Reading Avenue, South Van Dorn Street and Eisenhower Avenue and North Pickett Street near Edsall Road.

Since the last Council meeting in June, the City has initiated a new project for storm sewer flushing within the neighborhoods of Rosemont, Del Ray, Arlandria, West Taylor Run and Clover College Park. The storm water systems in these areas were selected based upon the systems' age and the number of areas experiencing problems during the flooding events of this year. The weather emergencies this year prevented a considerable amount of routine storm sewer maintenance cleaning from being undertaken in these areas. As a result, we have entered a contract (for approximately $100,000) with an outside vendor to undertake this backlogged sewer flushing work.

This contract work commenced on August 11 in the Del Ray neighborhood, and multiple crews will move through each neighborhood. By removing built-up debris from storm sewer pipes, this work will increase their capacity and reduce the likelihood of nearby flooding. The work is expected to take three to four months depending upon the obstructions encountered within the storm sewers. It will, however, be completed in each of these neighborhoods prior to this winter's precipitation.

c. Reduction of Storm Water Run-Off. On a different front, the City is now working in the land use development review process to reduce the amount of storm water run-off through improved environmental design. Run-off that enters the City's storm water sewer system increases as the amount of impervious surfaces within the City increases. Controlling the amount, as well as the "time of concentration," of run-off from impervious areas is extremely important in the City's overall effort to minimize storm water flooding.[4] The Fannon Color Printing site on Mount Vernon Avenue is an example of an environmental design intended to decrease the amount of run-off leaving the site. There, the parking areas are designed with an open paver system to increase the amount of storm water that is re-absorbed into the site.

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nearby storm sewer system, and design a collection system for the alley. The cost for this improvement will not be available until the design is completed this fall. The complexity of the work and its cost, as well as funding availability, will determine if this project can be done in FY 2004 or will have to compete for funding in FY 2005. There is currently no funding in the FY 2004 budget or CIP for this project.

[4] The "time of concentration" is the time it takes run-off from the farthest point in a drainage area to reach and contribute water to a storm inlet or drain. The more quickly storm water reaches the inlet, the more ponding or flooding will occur at the inlet.

The City's overall effort to reduce the amount of storm water run-off entering the storm sewer system will be significantly assisted by the increased focus, in the development review process, on improving the environmental design of systems that handle run-off from impervious areas.

We believe this series of capital and repair/maintenance activities will alleviate many of the sewer-related problems that residents experienced earlier this year. Some activities will be completed within a few months, while others (in particular, the I/I work in the Four Mile and Commonwealth sewer sheds) will take between two to three years to complete. Also, we will be continually watching for additional sanitary- or storm-related problem areas, and will respond accordingly as best we can.

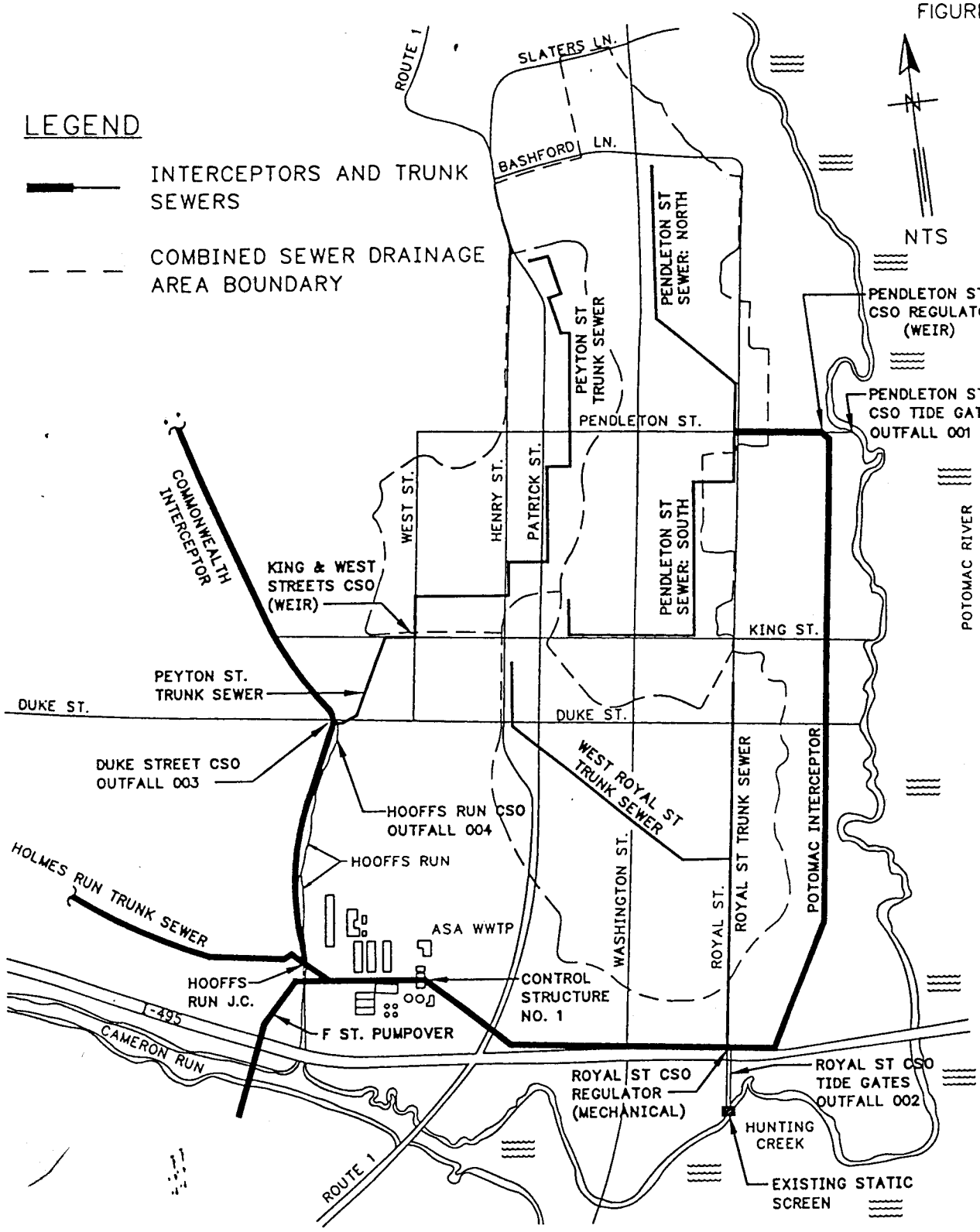
If you would like to discuss any parts of this memorandum, please call Rich Baier at 703.838.4966, or Emily Baker 703.838.4327.

Attachments: 1. Combined Sewer Map
2. I/I Map of Four Mile Run and Commonwealth Sewer Service Areas
3. Backflow Preventer Program Brochure

cc: Michele Evans, Assistant City Manager
Mark Jinks, Assistant City Manager
Eileen Fogarty, Director, Planning & Zoning
Art Dahlberg, Director, Code Enforcement
Emily Baker, City Engineer, T&ES

ATTACHMENT 1

FIGURE 1



ALEXANDRIA COMBINED TRUNK SEWERS AND INTERCEPTORS

CITY OF ALEXANDRIA, VIRGINIA
TRANSPORTATION AND ENVIRONMENTAL SERVICES
COMBINED SEWER SYSTEM

GREELEY AND HANSEN LLC

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Sewer Service Study Area Map

For more information visit our web site at
www.ci.alexandria.va.us/tes/ed/stormwater_infiltration_inflow_program